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Failures to integrate causally related outcomes of concurrent decisions

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Abstract

Problem statement: Sometimes concurrent decisions are not integrated. Purpose of study: An experiment was conducted to investigate whether causally related options of concurrent decisions are not evaluated and therefore not chosen although their combinations are more attractive than single options. In two concurrent decisions participants chose between buying means-end related and unrelated pairs of everyday consumer products. Method: Sixteen undergraduates in one group were sometimes forced to choose the end (or the means), whereas 16 undergraduates in another group were always free to choose the end and means. Findings and results: In the forced choices, participants chose the means or ends presumably because they attended to the additional benefits. Conclusions: However, when free to make both choices participants only chose the ends and means 22% of the time. 28% of the choices were made of only an end or a means, and 50% of the choices were made of two unrelated options.

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1. Introduction

Many decision making tasks require that decision makers make two or more decisions at the same time (Brehmer, 1992; Huber, 1990). Such decisions are referred to as concurrent. The decisions are completely dependent if the decision maker evaluates and chooses among all combinations of the outcomes of each of the options entailed by each decision. A more plausible assumption is, however, that such decisions are frequently independent or partially dependent (Garling et al., 1997). The important questions to ask are under what circumstances the outcomes of concurrent decisions are integrated, and how they are integrated. In its simplest form integration refers to adding the

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utilities of the expected outcomes of one of two decisions to the utilities of the expected outcomes of the other decision. The principle of utility maximization then predicts integration of the outcomes of the two concurrent decisions if the utilities of the outcomes of an option available in the first decision increase the utilities of the outcomes of an option available in the second decision. If such is not the case, the outcomes of the two decisions are not integrated. However, consider the following demonstration by Tversky and Kahneman (1981, p.454) violating the utility-maximization principle:

Imagine that you face the following pair of concurrent decisions. First examine both decisions, then indicate the options you prefer.

Decision (i). Choose between:
A. a sure gain of $240
B. 25% chance to gain $1,000, and 75% chance to gain nothing
Decision (ii). Choose between:
C. a sure loss of $750
D. 75% chance to lose $1,000, and 25% chance to lose nothing

A majority of participants chose A and D. However, in choosing between the following two alternatives they chose B´ which maximizes expected utility:

A´. 25% chance to gain $240, and 75% chance to lose $760
B´. 25% chance to gain $240, and 75% chance to lose $750

As realized, alternative B´ is B and C combined whereas A´ is A and D combined. Thus, participants did not make the two decisions which overall maximized expected value. Why did the concurrent decisions in this demonstration not maximize expected utility? It should first be noted that if the decisions are made independently, consistent with prospect theory (Kahneman & Tversky, 1979; Tversky & Fox, 1995; Tversky & Kahneman, 1992) each decision maximizes value. Because the value function is concave for gains and convex for losses, the value associated with a sure gain of $240 is greater than 24% of the value associated with a gain of $1,000. At the same time, the value associated with a loss of $750 is smaller than 75% of the value associated with a loss of $1,000. In addition Tversky and Kahneman (1981) assumed that in an editing phase, each decision was framed in a ”minimal account,” that is, as being made independently of the other decision. Such a decision frame may frequently be employed because it "(i) simplifies evaluations and reduces cognitive strain, (ii) reflects the intuition that consequences should be causally linked to acts, and (iii) matches the properties of hedonic experience which is more sensitive to desirable and undesirable changes than to steady states" (p. 457).

Boe and Garling (1998a, 1998b) investigated several of the possible factors counteracting integration which were implied by Tversky and Kahneman (1981). First, they assumed that the number of options and outcomes of each decision impose cognitive strain. In line with this assumption it was demonstrated that outcomes are integrated when they are certain but not when they are uncertain. For instance, a choice of a consumer product has a certain outcome which is integrated with another outcome whereas a choice of a lottery ticket with the consumer product as the prize is an uncertain outcome which is not integrated with another outcome. Uncertain outcomes impose cognitive strain partly because the number of outcomes increases, partly because the decision maker needs to imagine possible futures. However, since in Boe and Garling (1998a) the increase in the number of outcomes was slight, the latter factor may be the more important one.

Second, Boe and Garling (1998a) demonstrated very clearly that causally related outcomes were integrated whereas causally nonrelated outcomes were not. Thus, in their study, the added utility of choosing a means to an end influenced the choice when the end had been chosen or the reverse. In order to make concurrent decisions which maximize overall utility, a decision maker needs to attend to the additional benefit obtained from combinations of outcomes. Any factor distracting from or promoting this is likely to affect integration of the outcomes. In the Tversky and Kahneman (1981) demonstration reported above, it is possible that the outcomes of each choice (obtaining a sure gain or avoiding a sure loss) are so attractive that the combinations of outcomes are never considered. Thus, it is hypothesized that it is not a sufficient condition for integration of outcomes of concurrent

decisions that the value of the combination is larger than the sum of the values of each outcome. Such would be more likely if it could be assumed that a decision maker enumerates and evaluates all combinations of outcomes.

However, this cannot be generally true since it would impose too much cognitive strain. It needs to be assumed then that some selection is made of the outcomes to be evaluated. A reasonable assumption is that the decision maker starts with evaluating the outcomes of the single decisions. If these outcomes are very attractive, the decision maker may, however, never become aware of more attractive combinations of outcomes which are even more attractive.

The aim of the experiment we conducted was to demonstrate that combined options may not be evaluated and chosen although they are more attractive than single options. Employing the sets of consumer products used by Boe and Garling (1998a) we introduced one condition in which participants were forced to choose the end (or the means), then we asked them to choose between the means (or the end) and an unrelated option. This condition was compared to another one in which the first choice was not forced. If participants fail to attend to the additional benefits of the combined options, we expect more choices of the causally related options when they are forced to choose one of them than if they are not forced to do that.

2. Method

2.1. Participants

Thirty two undergraduates participated in the experiment in return for the equivalent of USD 7.00. They were recruited from a pool of undergraduates who at the beginning of the semester volunteered to participate in experiments. An equal number of men and women were randomly assigned to two groups of equal size.

2.2. Materials

The materials consisted of two sets of the consumer products used and pretested by Boe and Garling (1998a). Each set comprised four items in similar price ranges. Two items were chosen to be causally related to each other since they are means and ends (washing machine and tumble drier in one of the sets, telephone and answering machine in the other set). The remaining two items were unrelated (radio and alarm clock in one of the sets, refrigerator and dish washer in the other set).

2.3. Design

The design was mixed factorial with one between-subjects and two within-subject factors. Whether participants were forced to choose an option was varied both as a between-subjects and a within-subject factor. The remaining within-subject factor was whether participants were forced to choose means or ends. In the group with no forced choice the within-subject factors were dummy factors.

2.4. Procedure

Participants served in groups of four or less. When arriving at the laboratory, they were seated in private booths in front of a computer. They read general instructions presented on the computer screen. An experimenter was present to answer questions. The decision problems were then presented. All decision problems entailed two concurrent decisions, one consisting of a choice between a means and an unrelated option (e.g., telephone or radio) and the other a choice between an end and an unrelated option (e.g., answering machine or alarm clock). Each decision problem was presented three times according to individually randomized orders with the restriction that the same decision problem was never presented twice in succession.

All participants were instructed to choose the consumer product they wanted to buy in each of the pair of options. The forced-choice instructions given to one group of participants explained that they sometimes would be required to choose one option in one of the pairs. Which one would be indicated each time. Once they were forced to choose the end, once the means, and once they were free to choose which one they wanted. The forced choice options were written in capitals on the computer screen. Furthermore, the program controlling the presentation did not allow any

other choice than the forced one. The procedure was exactly the same in another group of participants except that no choices were forced.

One of the concurrent decisions was presented on the computer screen above the other. The position above or below, right or left position in a pair, and the unrelated item presented together with the means and ends were counterbalanced. Participants were instructed to attend to all the information presented on the computer screen while making their choices. Then they pressed return and responded to the decision problem above by indicating their first choice (A or B). After pressing return once again, they indicated their second choice (C or D). Participants were debriefed and paid after having participated. The sessions lasted for approximately 15 minutes.

3. Findings and Results

Table 1 displays the mean percentages of choices of means and ends in the groups with forced-choice instructions and with no such instructions respectively. As may be seen, the forced-choice instructions made participants chose the means and ends much more frequently. This difference was observed when choices were forced although a similar tendency was also observed for non-forced choices. Furthermore, choices of ends were somewhat more frequent when choices of means were forced than the reverse.

A 2 (group: forced choice vs. no instructions) by 2 (forced vs. non-forced choice) by 2 (forced choice of means vs. ends) mixed ANOVA with repeated measures on the last two factors yielded a significant main effect of group, $F(1, 30) = 33.47$, $p<.001$, MSe = .06, a significant main effect of forced vs. non-forced choice, $F(1, 30) = 39.19$, $p<.001$, MSe = .56, and a significant interaction between group and forced vs. non-forced choice, $F(1, 30) = 48.39$, $p<.001$, MSe = .69. Fisher-Hayter post-hoc tests at $p=.05$ showed that for participants who received forced-choice instructions, the choice of means or ends was reliably more frequent when they were forced to choose ends or means than when they were not, but that there was no such difference in the group of participants who did not receive the forced-choice instructions. Furthermore, the former group differed reliably from the latter group both when the choices were forced and when they were not.

Table 1. Mean percentages of choices of ends and means when participants were either forced to choose means or ends or were not forced.

	Forced-choice instructions	
	Yes	No
Forced choice[a]		
Ends	97.9	35.4
Means	85.4	33.3
No forced choice		
Ends	52.1	37.5
Means	52.1	35.4

[a]Varied as a dummy factor in the group with no forced-choice instructions. Data on the corresponding choices (e.g., of means when forced in one of the choices) in the other conditions are excluded.

4. Conclusions

The results showed that combined options may not be chosen although they are more attractive than single options. When participants with forced choice instructions were forced to choose the means or ends, they were likely

to choose the options in the other decision which were ends or means, respectively. This was in contrast to the choices made by the participants who did not receive forced-choice instructions. Thus, it may be assumed that the former group but not the latter attended to the additional benefits accrued from choosing the means and ends. Additional support for this is that participants with forced-choice instructions also tended to choose the means and ends more frequently when they were not forced to make any choices. It is possible that they became aware of the benefits from choosing the combined options.

Although the results are possible to interpret as if participants failed to maximize utility, the choices they made

may be reasonable. Consider that some participants had strong preferences for the unrelated options. If not forced to choose a means or end, then they were free to express these preferences in their choices. However, when forced to make a choice of a means or end, the complement may become more attractive leading to a choice of the end or means. A critical issue is if participants who were not forced to choose means or ends made choices of unrelated options. As Table 2 shows, it can clearly be seen that most participants who chose an unrelated option in the first decision continued to choose an unrelated option in the second decision. After collapsing the frequencies for choices of means and ends, a significant association was obtained, $\chi^2 1 = 13.30$, $p<.001$. However, suggesting that participants rather frequently made irrational (single) choices of the means and ends, about 28% of all choices were made of either a means or end. That about 52% of the choices were made of two unrelated items may possibly be accounted for by the fact that for some participants the sum of the value of the unrelated items was more attractive than the value of the means-end combinations.

Table 2. Number of choices of different combinations of options made by participants without forced-choice instructions.

	Choice of end/means	Choice of unrelated item
Choice of end	9	8
Choice of means	10	6
Choice of unrelated item	13	50

There are many conceivable situations where strong preferences for single options detract attention from the fact that certain combinations are preferable. Choosing dishes for a dinner with several courses is one example. Choosing combinations of travel modes (e.g., driving vs. walking) and destinations (close vs. far) is another example. As shown by for instance Read and Loewenstein (1995), a discrepancy in the impact of variety seeking occurs because simultaneous choices are presented together and are thus framed as a type of portfolio choice, whereas sequential choices are considered in isolation. In the sequential choice condition, the most straightforward choice heuristic applicable to a single choice is to choose the single most preferred alternative. Another example of "temporal bracketing" is found in research on self-control. A difference can be made between viewing an individual act of consumption in isolation and "bundling" it with other choices made over the long-term (Ainslie & Haslam, 1992).

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